1. Is the EPA saying that the Board is legally obligated to include all fish streams in this rulemaking?

   No, EPA can't tell the Board that it is legally obligated to include all fish streams in this rulemaking. However, EPA is responsible for ensuring that the provisions of the Clean Water Act are met. EPA reviews and approves the States water quality standards and beneficial uses, while the states' implement provisions to ensure those standards are met and the beneficial uses are protected. Achieving those standards and protecting the beneficial uses can be done in different ways and the state has the discretion to determine the approach to use. The important point is that when it is demonstrated that changes are needed to meet water quality standards and protect beneficial uses, changes need to be made. EPA believes that RipStream and previous studies show greater buffer protections are need for both medium and small fish-bearing streams and non-fish bearing streams.

2. Is the EPA saying that if only SSBT streams are included that it will not meet CZARA approval requirements?

   EPA and NOAA believes the science shows that greater buffers are needed for both medium and small fish and non-fish bearing streams. Under CZARA, States need to establish management measures that address non-point sources in the Coastal area. Management measures can be regulatory or voluntary but the scope of the management measure needs to address the problem. If State uses the regulatory approach to address SSBT only, the State would have to determine how to address the remaining waters via voluntary measures. Voluntary measures must be monitored for effectiveness and backed up by enforcement authorities should voluntary measures not be implemented or effective.

3. How can the PCW apply to streams with TMDLs when the PCW seems to target only streams that meet numeric criteria? Don't Temperature TMDLs apply only to streams not meeting the numeric criteria?

   PCW doesn't apply to streams where temperature TMDLs have been established. Where temperature TMDLs have been established, the allocations established in the TMDL must be met at the Point of maximum impact typically where the biological criterion is exceeded. If a TMDL has not been established, PCW applies where SSBT are present (habitat). In order for PCW to not apply, three exceptions must be met: 1) no T&E species; 2) No critical habitat, and 3) cold water is not needed to meet downstream criteria (PCW or biological). The assumption is that cold water is needed to meet the criteria unless an adequately done analysis shows otherwise. The biologically based numeric criteria apply to those waters on the State's 303(d) list

4. Isn't the prevention of .3 degree increases at individual harvest sites overly conservative and not necessary to protect beneficial uses?

   No, it is not overly conservative. The limitation of the .3 degree increase is intended to protect the natural thermal regime in waters colder than the numeric criteria, protect the

value in diversity of temperatures including temperatures colder that the biological based numeric criteria, prevent accumulations of heat in fish-bearing reaches, and helps retain the assimilative capacity for climate variation and climate change. It is known that heat gain is more efficient than heat loss and thermal energy can be transported downstream. ODFW and DEQ demonstrated that effect in Drift Creek Tributary study.

5. What evidence does EPA have that fish are harmed by stream warming of .3 degrees? (I will distill this into a more concise response)

Heating of headwaters reduces the extent of downstream waters at optimal growth & physiological temperatures & increases the extent at high-risk & lethal temperatures for rearing & migration.

Temperature effects typically occur on a continuum; increases from natural thermal potential increase risk to fish (McCullough 1999, US EPA 2001).

The natural thermal regime (NTR) is dynamic & variable, promoting biological diversity & resilience among fish populations & other native aquatic organisms (e.g. Watters *et al* 2003, Olden & Naiman 2010).

Landscape alteration & climate change alter the mean & *the variance* of these temperature components (Steel *et al* 2012).

Timing of fish life history attributes (adult migration, spawning, fry emergence, smolt migration) is partially mediated by the NTR (Vannote & Sweeney 1980).

Homing to natal streams & natural selective forces (including those imposed by NTR) result in distinct, *locally adapted* populations (Hillborn *et al* 2003).

Thermal diversity promotes aquatic biological productivity**.**

Fish use thermal diversity (temporally & spatially) so impacts to the "pattern" of temperature can be as significant as changes to the mean or maximum temperature (see DEQ 2003).

Fish detect & exploit thermal heterogeneity to avoid heat stress & to meet metabolic & reproductive requirements (Berman & Quinn 1991, Hodgson & Quinn 1991, Ebersole *et al* 2003, Torgersen *et al* 2012).

Variation in thermal regimes directly influences:

1. Metabolic rates, physiology, & life-history traits of aquatic ectotherms (see Holtby *et al* 1989 for salmonid example);

2. Rates of important ecological processes such as nutrient cycling & productivity;
3. Indirectly mediates biotic interactions (references in Olden & Naiman 2010).

b. Heat accumulation (& other homogenizing effects) can alter thermal heterogeneity before "average" main channel temperatures change (Poole & Berman 2001).
c. Multiple stressors in the environment must be considered. By preventing or reducing temperature stress, we reduce the risks due to multiple stressors on fish populations (e.g. OCCCP bottlenecks; e.g. Laetz *et al* 2014, Ray *et al* 2014).
d. When there is uncertainty, DEQ must make conservative choices to ensure protection of the resource.

6. Isn't it true that the paired watershed studies show that upstream harvest doesn't warm streams enough to harm fish and amphibians downstream?

   It is EPA's understanding that the temperature increases in fish bearing streams found in Hinkle and Alsea studies were within the range of responses from the RipStream study. Assuming that to be true, we know what the findings from RipStream are, and we also know that small amounts of heat can have impacts on water quality and fish. Heat can accumulate and thermal loads do move downstream. Heating of headwaters reduces the extent of downstream waters at optimal growth & physiological temperatures & increases the extent at high-risk & lethal temperatures for rearing & migration.

7. RipStream shows that temperature changes are temporary so they are not a big deal

   The RipStream analysis showed that where state rules for riparian buffers were implemented on state owned forestry lands, temperatures did not exceed the PCW criterion. As such, we are unaware of further analyses that were conducted on the data coming from the application of state riparian rules on state lands.

8. RipStream demonstrates that state rules are adequate for streams.